RANCH DAY

OCTOBER 10, 1949

New Mexico Experiment Station, New Mexico Extension Service
Southwestern Forest and Range Experiment Station

1936

1949

Encroachment of mesquite brush on good grassland range in a 13 year period

Experimental Ranch

New Mexico College of A. and M. A.

Jornada Experimental Range

Southwestern Forest and Range Expermental Station

JORNADA EXPERIMENTAL RANGE

Jornada H.Q.

Rincon

Feeding Corrals

Mayfield Well

Camp Well

Co'op Well

Airplane spray plot

Supplemental range feeding

Mesquite control stops

Seldon Well

COLLEGE RANCH

College H.Q.

South Well

Summerford Mts.

Radium Springs

Las Cruces

SECTION OF COLLEGE RANCH AND JORNADA EXPERIMENTAL RANGE
SHOWING RANCH DAY ROUTE

1 2 3 4
Miles

Legend

Fence
Route
Boundary fence
Well
9 Pasture No.

SECTION OF COLLEGE RANCH AND MIRANDA EXPERIMENTAL RANCH

SHOWING RANCH DAY HOUSE

PROGRAM

NINTH ANNUAL RANCH DAY

Ivan Watson, Extension Animal Husbandman,
New Mexico Extension Service, Presiding

7:30 A.M. Leave courthouse, Las Cruces. Leave Radium Springs 8:00

8:30 MAYFIELD WELL

Production from Two Types of Cattle - Marvin Koger

9:15 PASTURE 1 WATER

Spread of Mesquite and Its Early Control - K. A. Valentine

How P.M.A. Can Help in Shrub Control - Hoy Connelley, in charge A.C.P. Program Operation

Our P.M.A. Program for the Control of Juniper - G. V. Clayton
Chairman Otero County A.C.A. Committee

10:10 CAMP WELL

Relationship of Gain on Range to Feed Lot Gain - Marvin Koger

Occurrence of Cancer Eye in Range Cattle - J. H. Knox

11:20 HEADQUARTERS

Exhibit on Range Condition - J. L. Gardner, Soil Conservation Service

Lunch

12:20 Welcome - John W. Branson, President, New Mexico College of Agriculture and Mechanic Arts
Raymond Price, Director, Southwestern Forest and Range Experiment Station

12:30 Need for Shrub Control on New Mexico Ranges
Albert Mitchell, Albert, New Mexico

12:50 Feeding a Salt and Cottonseed Meal Mixture -
W. O. Culbertson, Jr., Bueyeros, New Mexico

1:05 The Carotene (Vitamin A) Value of Range Forage and of the Blood of Range Cattle - W. E. Watkins

1:50 P.M. PASTURE 1

Progress in Control of Established Stands of Mesquite -
K. A. Valentine

The Outlook for Cheap Chemicals for Controlling Noxious Range Plants - J. W. Gibson, Dow Chemical Co., Houston, Texas

2:50 P.M. ENTER JORNADA EXPERIMENTAL RANGE

3:00 INSPECTION OF MESQUITE SPRAYED BY AIR, RANCH DAY 1948

Range Research of Southwestern Forest and Range Experiment Station - C. Kenneth Pearse

Some Results of Research in Mesquite Control - G. E. Glendening

4:10 PASTURE 9

Salt-Meal Mixture Feeding Improves Forage Utilization - F. N. Ares

PRODUCTION FROM TWO TYPES OF CATTLE

By Marvin Koger

A study was begun in 1945 to determine the effect of type and size of cattle on such economic characters as growth, efficiency, longevity, and reproduction. At that time two groups of cows were selected from the experimental herd, one herd being selected solely on weight, and the other on compactness. The groups have been mated to bulls similar in size and type to the cows, and replacements selected from their progeny to increase the difference between the two herds. These groups have been compared with the regular experimental herd.

The records have shown, each year since the beginning of the experiment, that the weaning weights of large calves have been heavier and the grade lower than those of either the regular herd or the compact group. The grades of calves from the compact group have been higher and the weights lighter than either of the other groups. Thus, the groups rank in weight production in the order of big, regular, and compact; and in grade of calf, in order of compact, regular, and big. The 1948 data are shown in the accompanying table.

As far as efficiency in the feed-lot is concerned, it appears that type and inherent size of cattle may make little difference. The large steers gained more than compact steers, but they also ate more, the efficiency of the two groups showing no significant difference.

It is pointed out that our results are from groups of cattle that differ in average inherent size. They indicate to us a comparable efficiency of cattle of various average sizes and types. Other studies, however, have shown that within a group of cattle of inherently similar size, the larger, more growthy cattle are more efficient. This would indicate that regardless of the type and size of cattle being produced, the more growthy, thrifty cattle should be retained for breeding purposes. Indeed our observations in this experiment suggest that some attention to "good doing" qualities is indicated to avoid "knot heads" that are unprofitable.

Table 1. Feed-Lot Data from Calves Produced by Large and Compact Cows

	Large	Compact
Initial weight, lbs.	464	420
Gain, lbs.	421	396
Daily Gain, lbs.	2.14	2.02
T.D.N. required for 100 lbs. gain	555	530
Shrinkage	5.2	6.0
Selling price, dollars cwt.[1]	26.00	26.00
Dressing percent	59.4	60.4
Carcass scores[2]		
General	6.5	6.5
Form	6.5	5.8
Finish	6.0	6.5

1/Buyers generally valued the large calves at $0.50 lower, but the cattle sold at the same price

2/Grade of 6 is good, 7 is low good

Table 2. 1948 Weaning Data from Type-Size Experiment

	Compact	Regular	Large
Av. Standardized wt. of calves, lbs.	383	401	422
Av. grade of calves[1]	108.6	106.8	105.2
Av. weight of cows at weaning, lbs.	897	910	1,030

1/ 100 is equivalent to B plus, 110 to A minus, etc.

SPREAD OF MESQUITE AND ITS EARLY CONTROL

By K. A. Valentine

It should be stated at the outset that we do not know all we should like to know, or need to know, about the spread of mesquite and the factors that affect it. Much of what we do know comes from general observations, but systematic observations are being made which are adding to our knowledge of the problem. We do know that this species has invaded and is still invading much good grassland throughout the Southwest. We do not know all factors that cause the seed to be disseminated nor the extent to which each may be responsible for spread. Seed have been found in the droppings of rabbits, coyotes, and domestic livestock. Many established seedlings have been observed growing from the droppings of domestic livestock. It may be observed, too, that the seedlings frequently become established in grassland that has not been destructively grazed. This is not to say that destructive grazing plays no part in establishment and growth of mesquite plants, for it has been observed that excessive grazing and trampling of grassland has induced extraordinarily large numbers of seedlings and caused their very rapid growth.

Even though we do not know with exactness the factors responsible for seed dissemination, seedling establishment and growth, our observations on the increase of mesquite lead us to conclude that we must develop and employ aggressive control measures against mesquite.

This brings us to the subject which we want to discuss at this point. This is control in the early stages of invasion when plants are few and small, in fact before many of us would recognize that we had a mesquite problem at all. The pasture to the north of us here illustrates just this condition. To look out over it, one could reasonably conclude that there is little, or no mesquite on the area. Yet there are enough plants already established here to make a bursh range of the area if they are allowed to develop to full size. In order to better show the amount of established mesquite already in this area, we have flagged all plants on a ten acre block. It may be seen from this that the area, although seemingly free from mesquite is in fact well invaded. All our observations and those of others indicate that we can expect with certainty that the small, inconspicuous plants, we have staked here will, through growth and reproduction, convert the area into a mesquite dominated range in not very many years.

In connection with control at this stage of invasion, there are several points that are worthy of careful consideration. First, most of the plants on the area are small and are producing little or no seed as yet. It appears to be extremely important to remove them before they reach the size that seed production on the area is abundant. Records from one plot on the ranch located where seed production is abundant, show that between 1940 and 1947 new mesquite plants became established at the rate of 147 per acre. On another plot where a stand of mesquite had been grubbed, new plants became established between 1938 and 1948 at the rate of 108 plants per acre. To allow plants to reach the size in which seed production is plentiful is to compound the control problem

several times. Next, rate of resprouting from the larger plants appears to be much greater than from the smaller plants owing to lower success in removing bud bearing tissue from the larger plants. Another point to be considered is the fact that at this stage of invasion no appreciable damage has as yet been done to the grassland. On the other hand if control is delayed until the mesquite become large and more numerous, the grass cover will be damaged, forage production will be reduced and considerable time, almost certainly running into years, will be required to restore the grass cover to good condition. All these points strongly indicate that in order to prevent damage to the grassland and impaired grazing value at the least cost, the control job is best done as a preventive type at an early stage of invasion.

As to type of control at this stage of invasion, no other method appears to be as effective as hand grubbing. The condition which makes this true is the small size and widely scattered distribution of plants. This requires that a range be carefully gone over in order to find all plants, an operation that seems to be best done by a worker on foot. Further, the plants, being for the most part small, may be removed by one or a few strokes of a hand tool; no great effort is necessary to get them out.

Recognizing these facts, we have this past season embarked on a control campaign on this type of range land. What we have done is just a beginning and will have to be continued on a greatly expanded scale in following years. This summer's work in this pasture consisted of hand grubbing all small plants and some isolated large plants. A number of large plants in groups or small stands were left for later treatment by other methods because hand removal of the larger plants is uneconomical. This practice of using two or more control methods in combination may have to be generally followed, since large and small plants are perhaps best controlled by different methods.

Several points of useful information were obtained from the work done. A total of 3,030 plants were removed from 400 acres at a cost of 115 man hours labor. These data yield a cost of .28 man hours per acre. This is not a low cost when judged by the actual number of mesquite plants removed but when it is considered that much of the work consists of the very necessary work of searching out the plants the cost does not appear too high. When it is further considered that the work prevents the development of thicker stands of large plants which would require a considerably greater outlay of time and money the work appears to be well justified.

There are a few precautions that need to be carefully observed in order to make the most of the time spent in a hand grubbing operation. First, some means must be used to make certain that the area is completely covered but that no large overlap is needlessly covered more than once. We have found from last year's work that flags set up to mark guidelines are a very considerable aid in getting coverage of an area. Second, it is essential that the plants be removed deep enough to get all potential bud bearing tissue. On smaller plants this may extend downward below the crown 3 or 4 inches, while on larger plants they may be found at a depth of 8 or 10 inches. Failure to remove

the part of the plant that can produce buds will result in regrowth of the plant. Resaonable care should be taken to find all plants and treat them in a way that will prevent their resprouting.

Now we dislike to recommend such a primitive and laborious method of shrub control as hand grubbing at a time when so many modern methods and materials and modern equipment is in use in agricultural production. We know, of course, that hand labor and foot travel are generally inefficient by comparison with machine power methods of doing work and traveling. Nevertheless, when all conditions that pertain to mesquite invasion and control are considered, it certainly does appear that early control by hand operation is one of the most promising control practices.

Now, we would like to mention briefly another type of work closely related to this early control discussed. This is the clearing out of single plants and small isolated stands of plants around watering places, along trails, in fence corners, and other places where stock congregate. These plants are the source of much seed which is scattered by stock over rangeland, thus bringing about the establishment of new plants in uninvaded areas. The area near the water trough just to the south of us here represents this kind of stand. Most of the plants here were sprayed with 2,4,5-T but a few were sprayed with 2,4-D. It is too early to say what kill we will obtain on these plants. We did use a concentration that yielded good results last year and recent examination indicates that we have obtained very good results with one of the 2,4,5-T applications. The thing we want to emphasize here, however, is the need for control of this kind of stand before the whole pasture becomes infested with mesquite from this seed source. The actual method of removal might be one of several that have been worked out: power machine methods, treatment of cut stump with oils, or the spraying method used here. It would seem too, that on this type of stand, one that is a source of seed for infesting large areas, we would be justified in spending some more and maybe considerably more time and money per plant or per acre than we would if we were concerned only with the direct effect of the mesquite on the forage production on the immediate area. The cost might well be considered as properly distributable over the large outlying pasture area, much of which is as yet relatively free from mesquite but which is almost certain to become infested if the seed source stands are left. We do not wish to imply that this is the only seed source stand in this pasture, however; other stands will also need treatment to reduce seed dissemination.

This type of work may appear to be too remote from the main problem to warrant attention, but when we realize that it is on such seed sources as these that much mesquite invasion depends we think that it is quite sound to undertake control of this kind of stand.

One further point may well deserve mention. It is our feeling that control work of this type is important enough and effective enough to warrant a well organized and sustained effort. It can not be effectively done as an incidental job, done when and where slack time permits. The natural factors bringing about the encroachment of

mesquite on grassland range are operating,perhaps slowly, but continuously, day after day, month after month, and season after season. The cumulative result of this is great. It will not be offset or undone by hit-or-miss, sporadic efforts.

HOW P. M. A. CAN HELP IN SHRUB CONTROL

By Hoy Connelley
Administrative Officer, New Mexico State PMA Office

Competitive brush on our New Mexico rangelands is now being recognized as a major problem by all who are interested in grassland agriculture. The invasion of such plants as mesquite, juniper, cactus and others has been progressing for many years but it is only within recent years that ranchers, range technicians and the general public have realized that the invasion has become formidable.

For several years research men in the southwest have been studying ways and means to prevent the encroachment of these competitive plants on native grasslands. Various methods have been tried for controlling or eradicating the brush which has already become established and is competing with the desirable forage species for the available moisture and plant food in the soil. In many instances research men found efficient and economical ways of preventing further invasions; however, they are not satisfied with their progress in the development of efficient and economical methods for control of the brush which has already become established. They are continually increasing their efforts along this line.

The general public now has become aware that it also has a part in the fight which is being waged against this enemy of the livestock industry. This is indicated by the authorizatiom of federal funds to be used in defraying a part of the cost involved in carrying out brush eradication methods.

Incentive payments for shrub control were first made available in 1940 through the facilities of the Agricultural Conservation Program, which is now a branch of the Production and Marketing Administration. Each year from 1940 until the present time a few ranchers have received monetary assistance for the control of competitive shrubs on their rangeland. The amount accomplished through the Agricultural Conservation Program has not been great, due to the fact that economical methods of shrub control have not been available.

The Production and Marketing Administration is now placing more emphasis on the shrub control problem. They are ready to include as a range conservation practice any method of shrub control or eradication which has proven feasible and economical. Financial assistance amounting to approximately half the cost of carrying out an adopted control practice will be offered.

PMA assistance is now offered for hand-grubbing or otherwise killing small mesquite seedlings which are infesting an area. The State PMA Committee does not feel justified in approving assistance for the control of mesquite in an established stand until cheaper and more effective methods have been developed. However, it is probable that in certain areas established stands of mesquite can be controlled

by the use of oils or by such an implement as the root plow. In such cases, assistance may be given if there is sufficient evidence to justify the expenditure of federal funds.

In many areas in the State the control of pinon and juniper can be accomplished economically by such methods as hand chopping, bull dozing and cabling. Sagebrush may be eradicated by plowing, rolling or the application of chemicals.

Through experience we have learned that a great deal of caution must be used in determining whether or not the practice of brush control should be carried out on a given area. Assistance should be given in carrying out the practice only if the area from which the competitive plants are removed can be revegetated through natural or artificial means. In many areas which are infested with competitive plants the native grasses have been completely crowded out, with no remnant from which a grass cover could become established. The removal of the shrubs from such an area would be detrimental unless a desirable cover could be obtained by artificial reseeding. If the area can be reseeded, the rancher can obtain assistance through the ACP amounting to approximately 80% of the cost of the seed.

It should be realized that the original removal of the competitive plant is only half the battle. Therefore, one of the conditions of payment is that the land owner accepts the responsibility of managing his range in a manner so as to avoid reinfestation.

As mentioned in the beginning, research men and range technicians are continually increasing their efforts to find more effective and economical methods of shrub control. Often they are handicapped by lack of funds necessary to carry on large scale operations. It is possible that this obstacle may be overcome by a cooperative agreement between the research men, rancher and the PMA. Under such an agreement a practice could be selected which showed promise from preliminary experiments. The PMA would approve payment for carrying out such a practice on a limited acreage, provided the rancher was willing to furnish the area to be treated and stand a small portion of the cost; and provided further, that the practice would be supervised by a research agency. By adopting such a practice means would be provided for testing the applicability of various methods in the field. If field tests proved successful, the practice could then be made available for large-scale application.

The PMA through its ACP Branch is in the business of soil, water and range conservation. It operates as a Government-farmer-rancher partnership based on the philosophy that there is profit for the individual farmer or rancher and the Nation in the conservation of agricultural resources.

The New Mexico State PMA Committee feels that the common problem of competitive shrubs on New Mexico rangelands can be solved by sound controlled measures carried out by individual ranchers with the assistance of ACP funds.

RELATIONSHIP OF GAIN ON RANGE TO FEED LOT GAIN

By Marvin Koger

Frequently the question has been discussed whether cattle that do well on the range are best adapted to the feed-lot, or whether the two capacities are opposed to each other.

Thirteen years records on steers that were grown on the experimental ranch and fed out at the college as long yearlings show that the good doers on the range are also the ones which make the best gains in the feed-lot. On the average, for every four pounds extra that a steer weighed off the range as a long yearling, he gained an extra pound in the feed-lot. Thus a steer that weighed 40 pounds above average off the range, gained 10 pounds more than average in the feed-lot. Steers that were heavy for their age as calves at weaning time were heavier than average as yearlings and gained in the feed-lot. Each additional 10 pounds at weaning was followed by 3 pounds extra gain in the feed-lot.

Likewise, quality on the range was consistent with quality after feeding. High grading calves graded higher than average as yearlings and showed higher than average fat grades after the feeding trials were over. As was the case with weights, there were, of course, many individual exceptions, but the above results were what happened on the average. Individual exceptions frequently discourage practical breeders but they should not make one lose faith in the general rule.

There was no significant correlation between grade and gaining ability. Thus, it is essential to consider both characters in choosing the most desirable animal.

OCCURRENCE OF CANCER EYE IN RANGE CATTLE

By J. H. Knox

Cancer eye is a troublesome condition that causes considerable loss among Hereford cattle in the southwest. Its occurrence is sometimes attributed to one or another of several different causes. Among these are faulty nutrition, particularly a lack of vitamin A, mechanical injury from harsh and thorny plants, dust and insect irritations, bright sunlight, and hereditary causes.

We shall consider first the causes other than heredity. Some of these doubtless have an effect, for the occurrence is more frequent in some parts of the country than in others. Of these causes bright sunlight has been most definitely associated with the disease. Dust and/or insect irritations seem a probable secondary cause for the condition seems to occur most frequently in regions where dust and insects are most troublesome. Poor nutrition and injuries from harsh and thorny brush may contribute sometimes but we do not believe they have been major causes here for we have had as much cancer among our purebred cattle on the best of irrigated pastures and farm feed as in the range herd.

On hereditary causes we have more conclusive information. In the first place, we know that the disease is influenced by heredity or it would not occur so often in one breed of cattle and so seldom in other breeds. Some believe that this is due to the white faces of Herefords. This may be true to some extent, in fact some experiment stations have reported less cancer among Herefords with red coloring around their eyes. However, here on the college ranch we have obtained data which shows that the degree of resistance to cancer in Hereford cattle is influenced by inheritance irrespective of eye coloring. In 1933 a young bull was placed in service in the college purebred herd which was superior to any bull used previously in regard to the weight and grade of his calves. However, the bull developed eye trouble at 4 years of age and was destroyed when he was 5 years old because of advanced cancer. Because of their weight and thickness, many of his sons were used in the range herd. The first crop of calves by these bulls was dropped in 1937.

The accompanying chart shows that cases of cancer were about 1 or 2 percent of the cows over 4 years old previous to 1945 and between 4 and 5 percent since that time. Our records show but few cases of cancer in cows less than 7 years old. From this we conclude that the increase in cancer was due to the large number of granddaughters of the bull referred to above that were of the susceptible age. At any rate only three cases of cancer developed between 1945 and 1949 which were not in the granddaughters of this bull.

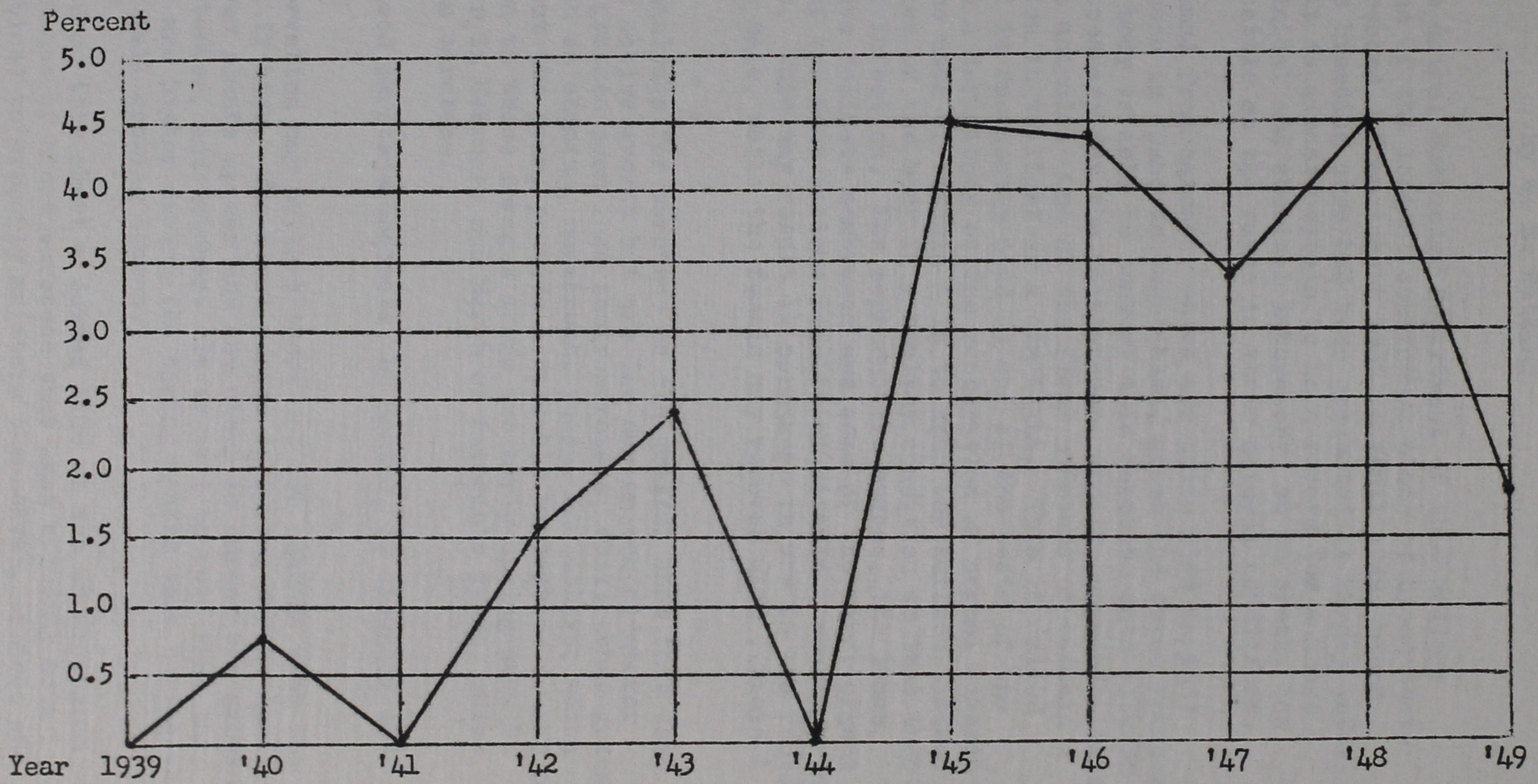
More conclusive proof of the influence of inheritance on cancer eye may be found in the records of three bulls, the first of whose calves were born in 1937. Two, which will be called "A" and "B", were sons of the herd bull mentioned above; "C" was a purchased bull and nothing is known of the occurrence of cancer among his close ancestors. The record

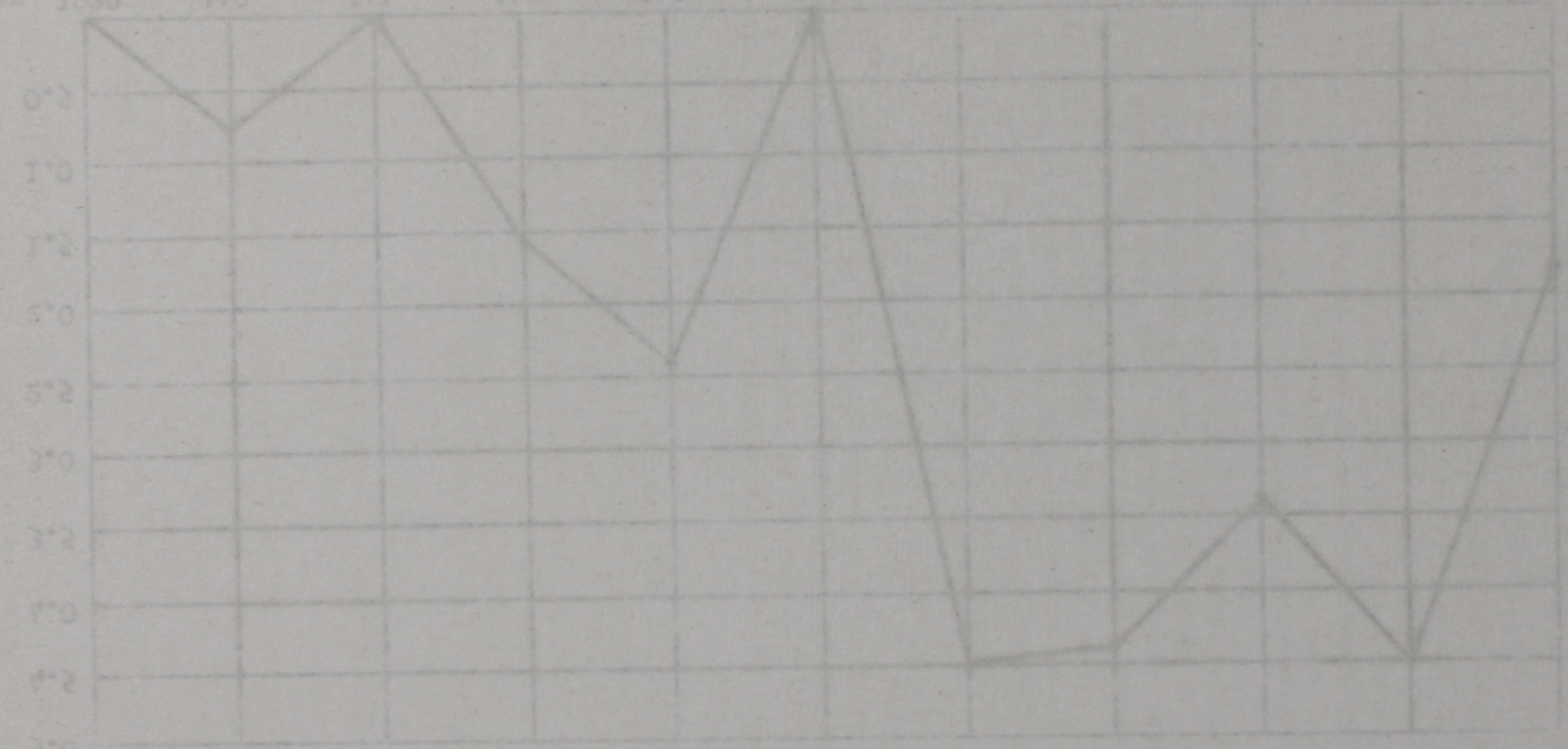
on their daughters is given below.

Sires	Daughters Kept	Cases of Cancer
A	42	14
B	36	4
C	29	0

"A" was sold at eight years old because of cancer and the other bulls were sold the following year because of a policy of using no bulls beyond 9 years of age. This shows the daughters of "A" to have a low resistance to cancer and those of "C" to have an unusually high resistance to the disease. Our statisticians say that such a wide difference between these groups of cows would have occurred by chance less than once in a thousand times. We believe that this evidence justifies a policy of eliminating animals with cancer eye from the breeding herd as quickly as possible and caution in the purchasing of young bulls from parents having cancer.

COWS OVER 4 YEARS OLD WHICH DEVELOPED CANCER





THE CAROTENE (VITAMIN A) VALUE OF RANGE FORAGE AND OF THE BLOOD OF RANGE CATTLE

By W. E. Watkins

Last April the Animal Husbandry Department of this college probably completed one of the longest continuous plans of blood testing and analyses on record. From August 1936 to April 1949, blood from 16 or more range breeding cows had been collected at 28-day intervals for analyses. It is almost certain to be a record for a range project where the clinical and chemical laboratory, so to speak, has been carried to the cattle on the range in their natural conditions.

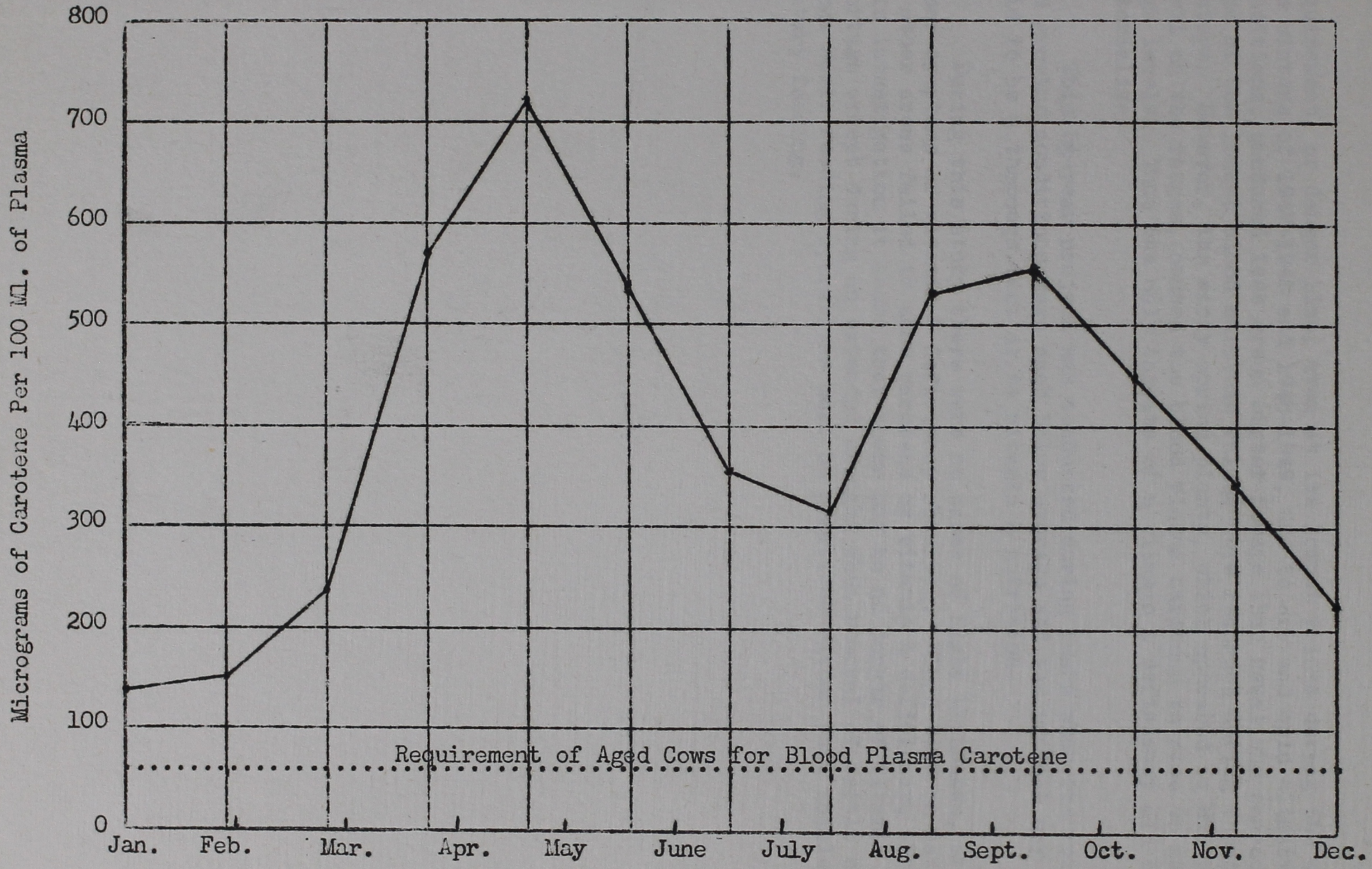
Carotene is named from carrots, which are quite high in this compound. This carotene is found in vegetables, green and cured forages. The human and animal body is able to convert this carotene into vitamin A. Vitamin A is quite necessary for the maintenance, growth, reproduction and the well being of all animals. One of the first symptoms of vitamin A shortage is poor vision in twilight or a dim light. This is called "night blindness" and is frequently used as one of the tests of the appearance of vitamin A deficiency or the restoration of normal vitamin A nutrition. One of the uses of vitamin A is to keep the surface tissues of the mucous membranes of the body in a healthy condition so that they will resist bacterial infection. The reproductive organs, the lungs, and the eyes which have delicate membranes are some of the first organs to be injured. One of the most serious results of vitamin A shortage is reproductive failures. This may result in permanent injury to the reproductive organs of the male, while the female may recover with vitamin A feeding.

The chemical analysis for carotene on the grasses show that they are quite high during active growth but are low during the midwinter period. The dormant grasses soon lose their carotene, while other grasses and browse plants such as chamiza, sagebrush, yucca, and others, which remain green throughout the year, provide a valuable wintertime source of carotene. In addition to these forages there are early spring annuals and weeds which appear in February and March of favorable years, which are also quite high in carotene.

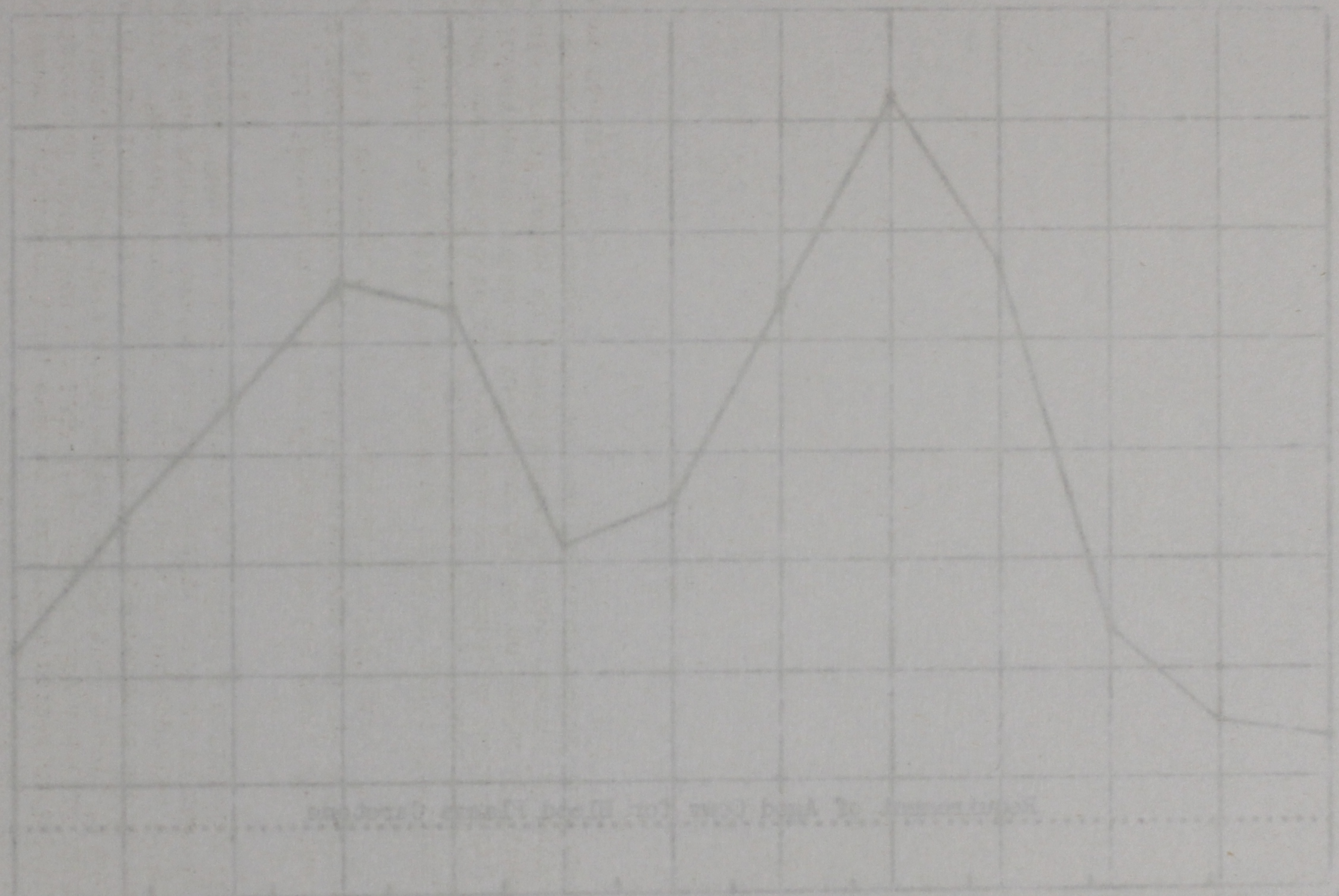
The average blood carotene analysis, by months, is shown on the accompanying chart.

The first observation may be that there are two seasons when the carotene in the blood is high. The first period is during March, April, and May, when the green plants appear and the other is during the growing season of August, September, and October. It is well to note that the blood carotene levels are higher during the spring months than during the usual late summer and fall growing season.

There is placed on this chart a dotted line at the 83 microgram level. This is the amount of blood carotene that aged breeding cows should have in their blood to properly maintain themselves, produce and nourish a calf. The blood carotene of these cows was well above this



Average Blood Plasma Carotene of Beef Cows
by 28-Day Periods ($5\frac{1}{2}$ years)



requirement, or danger line, even at its lowest points during the winter. The winters of 1947-1948 and 1948-1949, due to dry and cold climatic conditions, produced less green winter forage than usual and consequently some of the lowest blood carotene values were recorded during these winters. However, the early spring plants, which appeared in March and April on the ranges, caused the blood plasma carotene to rise to quite high levels. Thus the only threats of a vitamin A deficiency did not materialize.

This 5½-year project was conducted during years when the moisture and growing conditions were much below average and the project may be said to be a thorough test as to vitamin A nutrition.

During this study there were no cases of night blindness, or other symptoms of vitamin A deficiency observed. Blood test on cattle in other areas failed to show carotene or vitamin A deficiency. From this investigation it seems that there may be no danger of vitamin A shortage except during an extended drought when removal of cattle or large scale feeding operations must be practiced rather than supplementary feeding.

PROGRESS IN CONTROL OF ESTABLISHED STANDS OF MESQUITE

By K. A. Valentine

Much mesquite encroachment on grassland range has gone well beyond the point where control in earlier stages, such as was discussed this morning, can be applied. In stages of advanced encroachment other methods must be used. A great deal of work has been done along this line, but while some suitable methods have been worked out, fully satisfactory methods for all types of established stands of mesquite remain to be developed.

Methods of two general kinds, mechanical and chemical, have been used for control of mesquite. In the mechanical methods, plants are destroyed by root cutting, "tree dozing," cabling, and other such methods using more or less heavy power equipment. In the chemical methods, plants are destroyed by the application of chemicals to various parts of the plants.

Here on the experiment station ranch we have had an experiment on mesquite control going for three seasons. Most of the work has had to do with the chemical control although a limited amount, as you have seen, has dealt with hand grubbing. We have not as yet worked with the power machine methods but it is recognized that this method of control will probably have a definite place in mesquite control on this type of rangeland. We have concentrated on methods which are applicable to the many-stemmed, shrubby forms of mesquite common on rangeland in the state, since the application of oil and arsenic to trunks, stumps, or the ground around these, represents a degree of progress not yet attained for the shrubby form. The shrubby form is commonly covered with a deposit of windblown soil which makes the crown less accessible and presents a control problem considerably different from the more tree-like form.

During the first year our work consisted mainly of trying out different materials and concentrations to determine the more effective ones. During the second and third years, further trials were made with the more promising materials, including trials using different concentrations, mixtures, and conditions of applications. It is hoped that this will lead to the development of an effective treatment that will embody the best materials and conditions of applications. All trials have been on a small-scale, experimental basis, ten to twenty-five plants being included in a single trial, depending on their size. Among the chemical methods so far used are immersion of shoots and roots in arsenic solutions and solutions of the hormone-like chemicals, injection of chemicals into the soil near the crowns of plants and spraying of foliage and stems with chemicals, chiefly hormone-like chemicals. Not all types of chemical control treatments have been tried.

As you may see by observing the plants along the road, not many of these treatments were satisfactorily effective. This is not an unexpected or even wholly disappointing result, for among the many different treatments made, a few are looking good enough to be considered

quite promising. These promising treatments are the foliage sprays using the hormone-like chemicals. Among these, 2,4,5-T appears definitely best although some good results have been obtained with the 2,4-D esters.

It is entirely too early to attempt to report definite results from this season's work and even those for preceding seasons must be reported on a tentative basis until further work and observations are completed. At this location we can see the results of a 2,4,5-T spray treatment on a group of twelve plants which produced best results last year. The plants were sprayed with an oil-water emulsion containing 2,4,5-T. The spray consisted of 94% by volume of .25 percent 2,4,5-T solution and 6% by volume of kerosene to which an emulsifying agent was added. The plants were sprayed June 26.

Examination of the plants last fall showed that kill of tops was 95 percent or better for all the plants in the group, but that a few branches, particularly those lying near the ground surface and a few projecting beyond the main part of the tops, had apparently been missed. The plants bearing these branches produced weak sprouts from near and below the ground level which continued to grow this season. The total amount of regrowth is not excessive to date and can be covered with only a small fraction of the material used in the original treatment. Since incomplete cover seems to result in incomplete kill, it seems to be highly desirable to obtain as complete coverage as practicable with the first application. However, some kind of follow-up work to treat incompletely covered plants, missed plants, and resprouts will undoubtedly have to be a regular part of any control program. Five of this small group of plants have shown no sign of sprouting as yet, but continued observations next year will be necessary to determine whether they are in fact dead.

This year other similar 2,4,5-T treatments made in late July are showing results appreciably better than this group did last year, at the same time. These results give us reason to believe that with further work and development, 2,4,5-T sprays will prove sufficiently effective to permit its use in field scale control operations.

With regard to conditions of application of sprays, we have made trial applications this year to determine optimum time of year and time of day for spray treatments. Observations are not yet complete, hence we can report only part of and tentative results. Time of season treatments are not extensive enough to warrant any statement. It should be said, by way of caution, however, that this has been found elsewhere to be a most important factor. No spraying on a large scale should be undertaken until it is known that the season at which the work is to be done is favorable for satisfactory results. Time of day trials have indicated that spraying is most effective when done early in the morning.

We have done a small amount of work dealing with the value of adding oils to the sprays. This work indicates that there is a distinct advantage in adding a small proportion of non-toxic oil to the spray emulsion. We do not know as yet what the best proportion is. Five and ten percent additions by volume gave about equally good results. Kerosene

and diesel oil do not appear to produce this advantage, at least in the same proportions used for the non-toxic oil. Interference with absorption and translocation by the toxic oils may account for the difference.

Because we do not yet know definitely the concentrations, mixtures, and conditions under which acceptably effective results may be obtained with these sprays, we can not recommend their use in large scale trials. Our position in this connection is, in fact, more positive. Until a method has been proved to be effective, it should definitely not be attempted on a large scale. Needless failures of unproved, non-effective treatments applied on a large scale probably are a detriment rather than a benefit to the over all program of noxious plant control. It would appear that small scale, experimental trials, using similar mixtures and concentrations under similar conditions of applications to those found best here would be well justified. This should be particularly true in cases where the work is directed against the seed source type of stands discussed this morning, or other troublesome stands.

RANGE RESEARCH OF THE SOUTHWESTERN FOREST AND RANGE EXPERIMENT STATION

By C. Kenneth Pearse

The Southwestern Forest and Range Experiment Station and the College have agreed to take turns in presenting the bulk of the Ranch Day program. Since the College is chiefly responsible for the program this year, your time on the Jornada will be limited to two stops. Because of this it might prove helpful, especially to visitors attending Ranch Day for the first time, to briefly outline our over-all range research program and the place of the Jornada Experimental Range in the program. Range research at the Southwestern Forest and Range Experiment Station covers studies in three main phases; (1) grazing management, (2) reseeding, and (3) noxious plant control.

Studies of grazing management are aimed at finding practical methods of grazing that will maintain or improve our native ranges, yield maximum sustained production of market livestock, and increase the financial returns and security of the stockman, by minimizing the effects of drought and increasing the efficiency of operation. To attain better management practices we need better knowledge of our ranges and the plants growing on them. We need to know, for each principal range type, what are the desirable forage plants, how much forage is produced each year, whether it could be improved in quality or increased in quantity, and how closely, when, and under what systems it should be grazed. To develop proper methods of handling livestock on a range we need to know the grazing habits of cattle and sheep, which plants they prefer and when, how their movements can be controlled on the range, and how they can be managed to reduce death losses, increase weight gains, and to take advantage of labor saving devices. Finally each proposed practice must be evaluated in terms of financial costs and returns.

Range reseeding studies are aimed at finding practical, workable, and low cost methods of restoring a good forage cover on the more than 3 million acres of badly deteriorated rangelands of the Southwest. A limited reseeding research program has been conducted by the Station since 1945. Species that are adapted to grow and produce good forage under each of the many different climatic and soils condition must be found. Low cost but effective methods for removing undesirable vegetation, preparing the soil for planting and for placing the seed in the ground at the right depth and at the right time must be developed. Guides for selection of sites that will yield highest returns with most assurance of success from reseeding are needed. Finally proper grazing management practices for reseeded ranges must be worked out.

A beginning in research on control of noxious range plants has been possible only within the past few years. Trial and error testing of available herbicides has provided methods of control that are practical for some species but only where comparatively high costs can be justified such as to clear special pastures or handling areas or to check further spread. Cheaper methods that can be extensively applied are needed. To develop these we need to learn the growth habits and

life processes of the important noxious plants so that control methods will have a fundamentally sound basis. We need to know how poisons are taken into and how they are moved about within the plant, as well as how grazing animals, rodents, competition with other range plants, and other factors affect the spread and establishment of undesirable species.

To find the answers to these problems the Southwestern Forest and Range Experiment Station has, besides the Jornada, two other experimental ranges and numerous widely scattered experimental plots. On the Santa Rita Experimental Range in southern Arizona, we are attacking management, reseeding, and noxious plant control problems of semidesert shrub ranges. An experimental herd of 700 breeding cattle owned by cooperating stockmen facilitates the management studies. Much of the noxious plant control studies of the Station are concentrated at the Santa Rita, where laboratory and other research facilities are readily available. We are most concerned at this time with mesquite, but are doing some research on control of cactus, juniper, burroweed, and snakeweed.

At the Fort Valley Experimental Forest near Flagstaff, grazing management studies in the higher elevation pine type are centered. These are now aimed primarily at determining how grazing can be correlated with timber production, maintenance of watersheds, wildlife values and other uses of forested ranges. An important aspect is to devise a simple yet reliable method for evaluating the true productive condition of ranges, a study that is yielding many basic principles that can be helpful in judging the condition of other range types throughout the Southwest.

The three experimental ranges on which range research is concentrated are supplemented by less intensive studies and observations including some 30 plots for testing species and methods for reseeding throughout Arizona and New Mexico. Most of the reseeding effort has been devoted to the sagebrush, pinyon-juniper, and ponderosa pine types where reseeding appears most promising. Only exploratory studies have so far been made in the drier, more difficult types in the southern part of the region.

Here on the Jornada, grazing management studies conducted in cooperation with a practical stockman were started in 1915. Mr. Ace Christmas is our present cooperator and furnishes the cattle under a cooperative agreement with the Secretary of Agriculture. The 193,000 acres of the Jornada permit not only controlled and detailed investigations but also study of broad grazing management problems on a large scale practical basis. Our grazing management research is aimed especially at determination of grazing capacity, method for minimizing the drought hazard, and systems of grazing that are adapted to the needs of the forage plants as well as to the needs of the cattle. We have been able to conduct only limited studies in reseeding and noxious plant control on the Jornada.

As most of you know, we are experiencing a comparatively favorable year after two years of severe drought. In 1947, a total of 5.40 inches of precipitation fell, only 56 percent of the longtime average. Last year we received only 1.86 inches of rain during the growing season and practically no forage was produced.

This season, rainfall and forage growth have been generally good. Although there have been some dry spots, the amount of precipitation has been just about average, and storms have been well-timed. We are therefore seeing the recovery from drought that can be made in an average year under proper stocking. We believe it is important to be especially careful not to increase stocking rates too rapidly following drought, in order to provide the weakened plants an opportunity to build up their vigor and recover losses brought about by dry years. In the droughts of the past two years total stocking on the Jornada was reduced by approximately one-third. Such reductions are accomplished without undue hardship by holding the breeding cows to about 55 percent of the total normal or longtime average stocking rate. In time of drought, the balance, made up principally of weaner calves and yearlings, can readily be sold and removed from the range thus providing the necessary margin of safety to carry the breeding herd through without loss and with little if any supplemental feeding.

A measure of the benefits of this plan is provided by the record of calf crops which have been maintained at a uniform high level. Last year in the second year of drought, our calf crop amounted to 92 percent. This year, following two successive drought years, one would expect a serious drop in number of calves produced but on the basis of present brandings, and 83 percent crop, just about average, is indicated. Losses since the beginning of the year total only .06 percent of the total adult stocking of the range.

Practically all of the forage growth now on the ground has been made during the past four months. Growth is now completed for this grazing year and except for possibly a few spring annuals, no more forage will be produced until July of 1950.

Since entering the Jornada we have been in a black grama type. In accordance with our plan of management, this area has not yet been grazed this year. Because black grama cures well on the stalk, this type of range is reserved for winter and spring use. As you leave the Jornada by way of South Well you will pass through pasture number 6 which produces principally tobosa and burrograss. These grasses become unpalatable and low in nutrients and minerals when they dry, and are best used during the summer growing season. We concentrate use on our tobosa types in the summer and grazing on them for this year is now essentially complete. Cattle will soon be removed and held from the summer pastures until the 1950 growing season.

These examples of stocking adjustments and seasonal use of different range types will indicate to you something of our management philosophy on the Jornada. Our experiments have indicated that management must be based on the growth habits of the principal forage plants. This will provide for maximum growth and vigor of the plants and at the same time will yield ample forage so that livestock will be in thrifty condition at all times and can produce high calf crops, and good weight gains most economically.

SOME RESULTS OF RESEARCH IN MESQUITE CONTROL

By George E. Glendening

To men who are familiar with Southwestern ranges, it should be clear that the control of undesirable plants including mesquite, juniper, cactus, snakeweed, burroweed, and others poses two separate and distinct problems; first, how to eliminate or reduce the existing stands, and secondly, how to prevent the further spread or increase of these noxious plants onto range lands not yet occupied by dense stands.

We now know that large areas in the Southwest, although originally occupied by grasslands, are extremely vulnerable to invasion by woody plants when subjected to the influence of domestic grazing animals. Repeated studies have shown that under the conditions of limited precipitation which prevail in the Southwest, the thickening up of woody plants within a grassland type is invariably associated with decreased production of both forage and livestock. For example, our data show that the increase in mesquite has reduced the production of perennial grass forage by 50 percent on several of our most important forage types.

Consequently, if we are to keep our grazing lands in a reasonably productive condition, the control of noxious plants will have to be a part of the operator's regular and recurrent range improvement program.

Ranchers generally are anxious to begin the attack on the eradication of noxious plants as quickly as economical and effective means of control are made available. Many ranch operators are already doing a considerable amount of control work on their ranches despite the present high costs and, in some cases, only partially effective methods at their disposal.

Those of us in research realize that it is our job to develop economical and effective methods which ranchers can put into operation on a widescale basis. We are also aware of the urgency of the problem and the need for a quick answer. However, it is not an easy assignment when it is realized that we are faced with the task of eliminating stands of such trees as juniper and mesquite that may range from 50 to over 300 trees per acre on land that at best will support only one cow to 30 or 40 acres and may require 100 acres. Obviously a control method which will be practicable must be cheap as well as effective.

One method which appears to be promising and which is being widely used on sandsage in Oklahoma is the spraying of a selective (hormone-type) plant poison by airplane. About 300,000 acres have now been sprayed at costs ranging from $2 to $4 per acre and the sandsage on the bulk of the rangeland so treated has been effectively reduced or controlled.

On Ranch Day a year ago a 5-acre plot of sand-hill mesquite was sprayed by airplane. Chemicals for the demonstration were furnished by the Dow Chemical Company and the application was made by the Marsh Aviation Company of Phoenix. The material sprayed was 2,4,5-T in kerosene.

So far as the effects of the spraying on the present appearance of the mesquite is concerned, we see very little difference as compared with the adjacent untreated area. A more careful observation shows that the 2,4,5-T, as used in this demonstration, killed a small percentage of the top growth but had little effect on the buried stems and roots of the mesquites.

The poor results obtained in this demonstration are not condemnation of airplane spraying. To us, they serve to emphasize the need for a lot of know how which can be obtained only from additional trials and study. During the past year we have gained certain facts which will allow us to do a better job. Perhaps we won't kill all the mesquite but we can get better results than those obtained in the 1948 demonstration of airplane spraying.

In that demonstration we used the isopropyl ester of 2,4,5-T at a concentration of 2½ pounds (acid-equivalent) per acre, in 15 gallons of kerosene. Studies made since that time indicate that while the ester forms of 2,4,5-T usually produce rapid defoliation, they do not move well within the plant. In some of the tests which we now have underway, we are finding that the amine salts of 2,4,5-T produce a much slower top-kill when applied as foliage sprays, but are translocated within mesquite to a significantly greater extent than the ester forms. Hence the slow-acting amine salt of 2,4,5-T is more apt to produce a complete kill of the entire plant than the more immediately toxic ester form.

With respect to the best type of carrier for the hormone poisons such as 2,4,5-T, we are up against a problem. Light oils which penetrate the epidermis and bark much more effectively than water under our atmospheric conditions, also kill cambium and other conductive tissues and thus tend to reduce translocation of the hormone. The use of water-oil emulsions may be the answer to this problem which must be solved before complete kills can be obtained.

Much more information is needed as to the best stage of growth or time of year for spraying mesquite. In our studies of foliage sprays on one-year-old mesquite seedlings, we have obtained actual kills of 57 percent in early April, 40 percent two weeks later, 10 percent both on May 2 and May 16, and no kill from spraying during June or July at which time the plants were being subjected to drought and were apparently hardening off. These data which seem to show that mesquite is most susceptible to 2,4,5-T immediately after it leafs out in the spring need to be confirmed, and we will continue the study for another year. In practical application fixing of the proper time for spraying may not be so easy because soil moisture, which may be a key to successful kills by spraying, is often very low in the spring under our conditions.

There is a good deal of evidence that best absorption and movement of chemicals and best kills of mesquite are obtained when the spraying is accompanied or followed by a high relative humidity. Our laboratory studies show that absorption and translocation of sodium arsenite is markedly improved by exposure of the plants to a saturated atmosphere for 24 hours after spraying. Toxic effect of 2,4-D and 2,4,5-T was also improved by exposure of the plants to a high relative humidity after spraying

but the improvement was much less noticeable than in the case of the arsenic spray. We feel that this is an extremely important relationship, because if we are going to kill mesquite with foliage sprays of selective poisons in the Southwest, we must learn how to get effective absorption and movement of the herbicide in a dry atmosphere. Fortunately, there are some indications that we may be able to overcome this difficulty by the use of proper dispersing agents and carriers for the 2,4-D or 2,4,5-T.

Next there is the matter of specific toxicity of herbicides. It is now known that certain woody plants, as for example the wild currants and apparently sandsage, are especially susceptible to 2,4-D. Because of the unsatisfactory and erratic results which have been obtained from treating mesquites with 2,4-D and more recently with 2,4,5-T, there has been some question as to whether or not mesquites may be resistant or unsusceptible to these two herbicides. From controlled laboratory tests we have learned that minute quantities of both 2,4-D and 2,4,5-T will suppress growth and cause the death of young mesquite seedlings. In these tests we found that 2,4,5-T is significantly more toxic than 2,4-D. Further evidence that 2,4,5-T, when once in contact with the vital bud zone in mesquite, will produce a kill is shown by the fact that on freshly cut stumps which normally sprout profusely, we have been able to prevent sprouting completely by careful application of a small quantity of 2,4,5-T directly to the base of the stems. Other tests, yet to be confirmed, indicate that this method may have a place in the killing of large standing trees where these occur as individuals or in light scattered stands.

We have made laboratory tests of several other hormone-type herbicides applied to mesquite seedlings as foliage sprays, alone and in combination with 2,4-D and 2,4,5-T. None of these that we have so far tested has been as toxic to mesquite as 2,4,5-T. However, we are going to test all the promising new materials that we can obtain in the hope that something specifically more toxic to mesquite than 2,4-D or 2,4,5-T may be found among the great number of organic compounds known to possess plant killing properties.

During the past year we have also been active in trying to discover some of the basic processes involved in the reproduction of mesquite with the hope that an understanding of these may point the way to preventing or at least reducing the spread of mesquite. Some of our findings which appear to be significant are:

(1) On deteriorated semidesert grassland sites where stands of mesquite trees of seed bearing size are present, protection from grazing by livestock will not prevent the further establishment of additional mesquites. In fact, on two sets of carefully counted sample plots in southern Arizona where grass cover was thin and a stand of mesquite was present at the time of fencing, protection from grazing has aided both the establishment and growth of new mesquites during the 16-year period 1932 to 1948. The results from studies which we have set up to determine whether or not maintenance of a good stand of native grass will prevent mesquite seedlings from becoming established are not yet conclusive; but there is some indication that competition from large deep-rooted perennial

grasses including Porter's muhlenbergia, black grama, and Arizona cotton-grass may prevent or at least retard the establishment of young mesquite seedlings.

(2) In tests made during the past summer we have found that mesquite seeds, under our conditions, will seldom germinate and emerge when planted at a depth greater than 1½ inches, and that they consistently do not produce a rooted seedling when planted on the soil surface. We have also found that of the seeds which lie on the ground for 1 year after dropping from the trees, up to 80 percent may be drilled by the bean weevil (Burchus amicus). These facts point strongly to an animal factor as the important link in the distribution and planting of mesquite seeds.

The matter of seed dissemination by domestic livestock has been mentioned. There is no doubt that livestock spread a great amount of mesquite seed in their droppings during those periods when mesquite pods are available to them.

Another important agency in the planting of mesquite seed which we have only recently uncovered is the Merriam kangaroo rat. Population of this small nocturnal rodent is strongly associated with the presence of mesquite. The rat not only distributes mesquite seeds, but plants them in caches at the optimum depth and at considerable distance from the parent trees. We have enough information to indicate that control of this animal would result in a significant reduction in the number of mesquite seedlings which may emerge on areas already occupied by mesquites of seed bearing size.

SALT-MEAL MIXTURE FEEDING IMPROVES LIVESTOCK DISTRIBUTION AND UTILIZATION OF RANGE FORAGE

By Fred N. Ares

Supplemental feeding of all livestock on the Jornada Experimental Range as the result of drought has been necessary only twice within the past two decades; once in 1934 and again in 1948-49. Feeding of weaner calves and yearlings during the winter and early spring months has, however, been a regular practice since 1939. Four of the Jornada pastures, Nos. 2, 5, 9, and 10, the principal black grama pastures, are used for feeding. In accordance with our seasonal use plan of management, these are deferred in the summer growing season and reserved for winter grazing.

In the use of black grama range the proper distribution of cattle over the area is an ever-present problem. Around the permanent waters the so-called "sacrifice zone" develops where, because of congestion and heavy grazing, the desirable forage plants are so closely utilized that they may be replaced by less palatable or even worthless plants. At the same time the more distant points may be lightly grazed. Efforts to secure fuller utilization of the forage on these back areas usually result in extending the zone of too heavy use. The constant need is to keep the cattle well scattered. To this end the Jornada plan of salting cattle was designed to pull the cattle away from permanent water and out where the forage tends to be lightly grazed. This has been helpful but it still falls short of fully accomplishing the desired results.

Pasture 10 contains about 11 sections and is the principal feeder pasture of the Jornada. Because of the nature of the concentrate oil cake used, it has been necessary to feed in corrals in order to insure each animal getting the proper ration. Inasmuch as no feeding corrals existed on the range except near permanent water, feeding up to last year was done at the three watering places, Headquarters, South Well, and at Brock Tank. However, this method of feeding on the range proved undesirable because it failed to encourage proper distribution. In fact, cattle were encouraged to remain on those parts of the range near water and there was little incentive to graze the lighter used portions.

The introduction of the new cottonseed meal and salt mixture as a feed ration changed the picture considerably. This mixture may consist of varying ratios of the two ingredients as dictated by the condition of the animals, the amount of roughage available, and whether the objective of the feeding is to maintain the cattle or to secure weight gains. The mixture fed on the Jornada varied from a ratio of 50-50 to 80 percent meal and 20 percent salt, the richer mixture being fed to the yearlings. One of the most interesting features of the feed mix from the range standpoint is the fact that, in contrast to the oil cake, it can be placed out in the open and is accessible to all cattle, to provide a uniform and adequate ration for all feeders. This quality of the new feed immediately suggests that it might be used to increase use away from water without causing a corresponding increase in use at water.

In order to investigate this possibility, the feeding plan for the 1948-49 season included feeding the salt-meal mix both at and away from

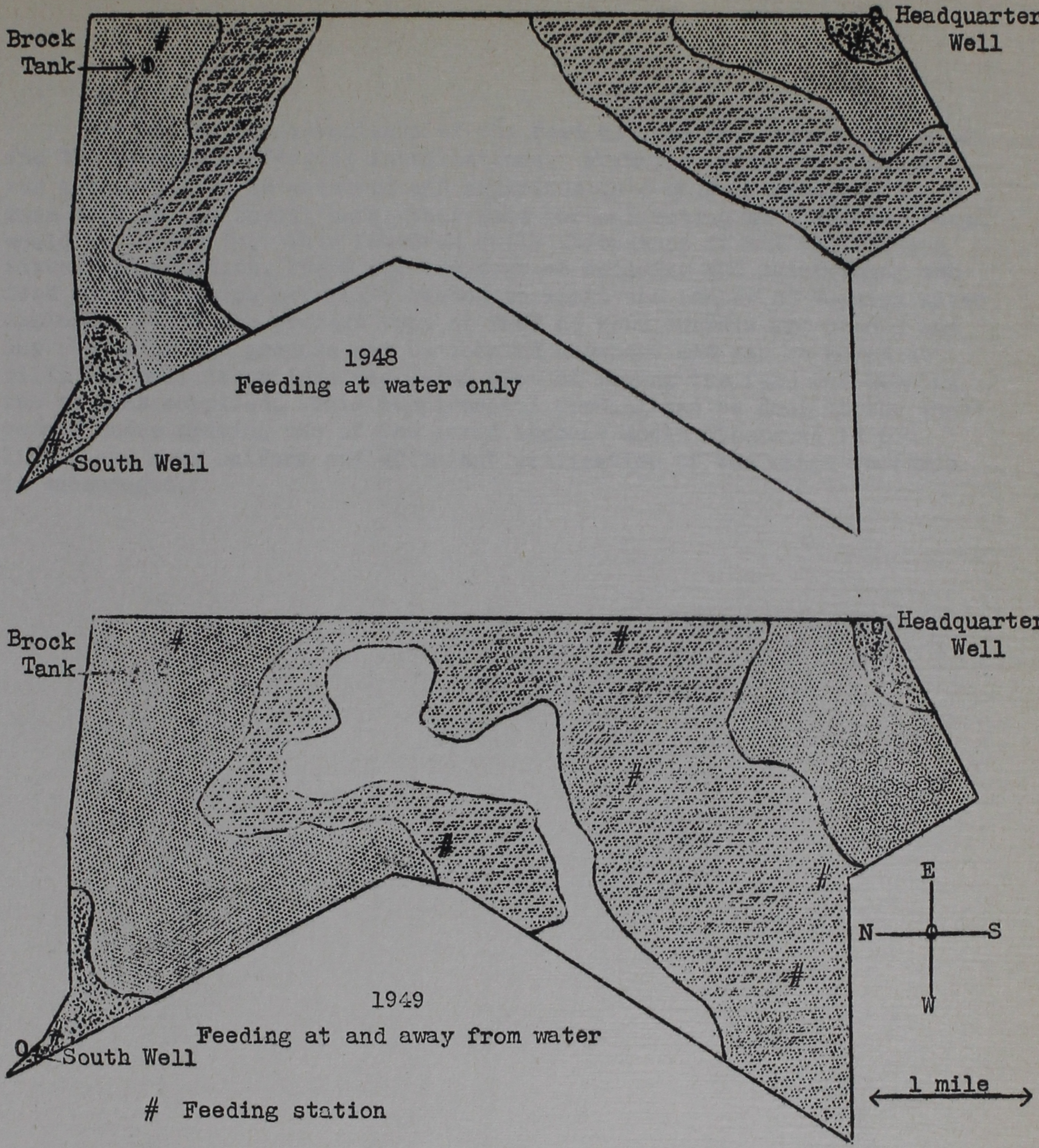
water. The out-station feed grounds, 5 in number, were carefully selected in order to provide the fullest coverage of the pasture. Three more sites were set up at the watering places in the pasture. Inasmuch as the feeding of the previous season, 1947-48 had been altogether at water and with the oil cake ration, it is possible to make some preliminary comparisons of the two methods of feeding as they affect distribution of cattle, utilization of forage, and other developments of interest to range stockmen.

This first test of the new feed mix on the Jornada is complicated by the recent drought conditions. Since practically no forage was produced last year, only the reserve carry-over from previous years was available for grazing. Thus use in the two years was cumulative, and by the end of 1949 on the whole, was considerably heavier than is desirable.

Nevertheless, the utilization pattern in pasture 10 was much more uniform in 1949 with the salt-meal mix fed at and away from water than in 1948 when feeding was possible at water only (see map). The portion of the pasture that was properly used - from 30 to 50 percent of the total herbage grazed - was more than doubled. It increased from 23 percent of the pasture in 1948 to 47 percent in 1949. Whereas 55 percent of the area was grazed lightly - less than 30 percent of the herbage utilized - in 1948, this was reduced to only 12 percent of the area in 1949. The effectiveness of the salt-meal mix in drawing cattle into little used areas is shown by the fact that in 1949 all parts of the pasture were grazed enough to use at least 20 percent of the herbage. In contrast, in 1948 with feeding at water only, as much as 39 percent of the pasture was grazed so lightly that less than 20 percent of the herbage was utilized.

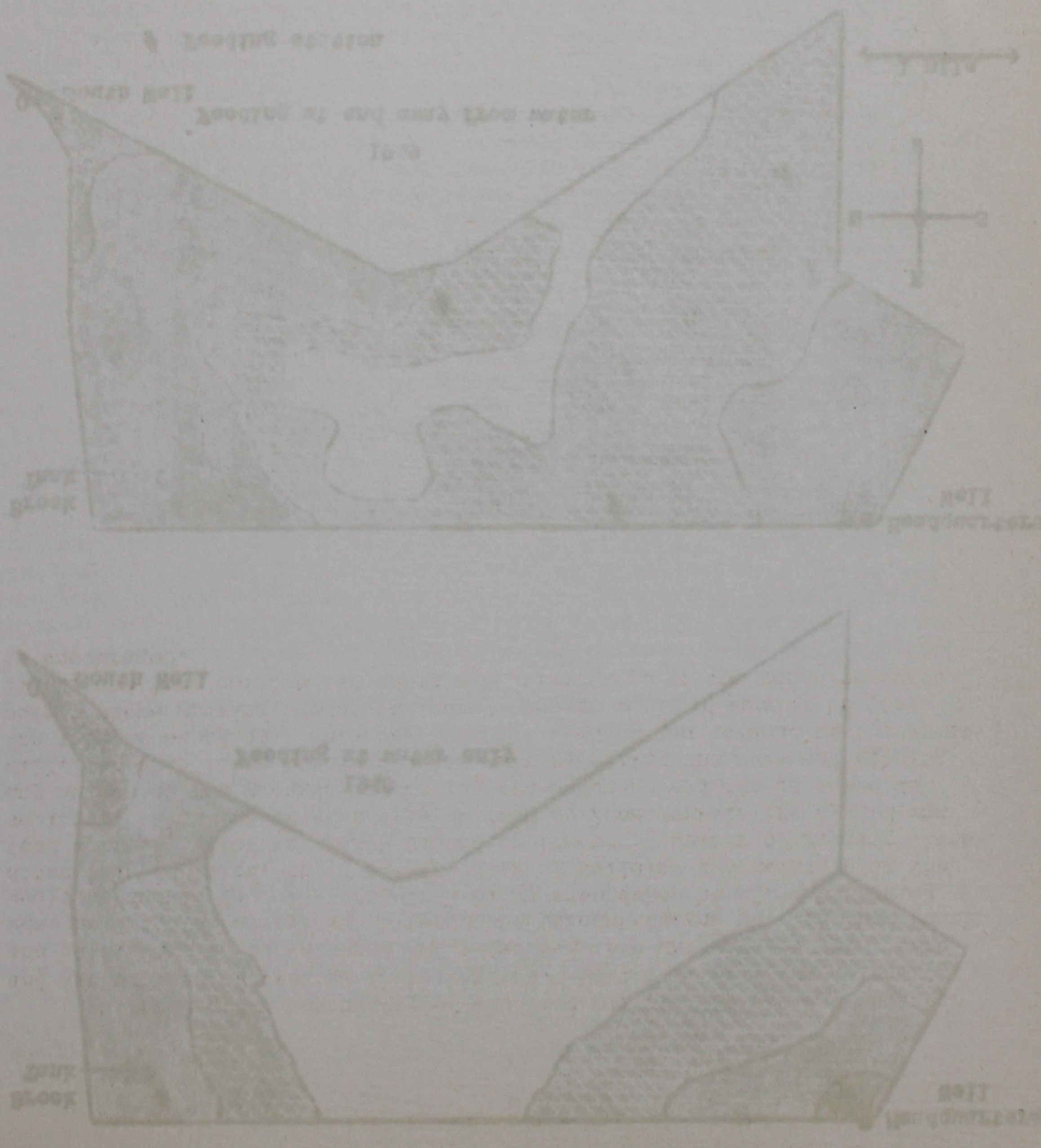
While fuller use of the pasture as a whole was accomplished in 1949, areas that received seriously excessive use - grazing of over 70 percent of the herbage - were increased only slightly. There was a disturbing increase in the areas that received less serious, but still objectionable overuse. From 50 to 69 percent of the herbage - too much for continued maintenance of the range - was removed from 19 percent of the area in 1948, but this was increased to 36.5 percent in 1949. Part of this, of course, was due to the failure of the forage crop in 1949 and the necessity of continuing grazing on the carry-over of unused forage from previous years. Such close use is not recommended and is to be avoided on any sizable portion of the range. Further tests in subsequent years will finally determine how effective feeding of salt-meal mix at scattered stations in the pasture can be in making proper use of a large part of the pasture, as was achieved this year, but at the same time holding the excessively used areas to a minimum.

An interesting sidelight of the salt-meal feed test indicating that it will be desirable to feed it mostly away from water has been brought to our attention by the Cooperator. This is the tendency of the feeders to foul the water supply if fed close to water. If the animal drinks immediately after eating, some of the sticky mixture is carried to the water, which soon begins to emit a foul odor and a cleaning job is required.



Degree of use	Area so used in 1948	Area so used in 1949
Heavy	3.6%	4.6%
Full	17.1	36.5
Proper	22.7	46.7
Light	54.6	12.2

FORAGE UTILIZATION IN RELATION TO LOCATION OF FEEDING STATIONS
JORNADA PASTURE 10



Other decided advantages of the feed mix are the savings in labor and the expense of feeding installations. Formerly, with the oil cake, the cattle had to be gathered and separated into uniform groups. These were held in the corral until they were through eating when another bunch would be turned in. This required daily attendance at all the feeding sites. In addition, there was the cost of building and maintaining the feed corrals, which naturally tended to limit the number of feeding sites employed. With the present type of feed no feed corrals are needed and any number of the grounds may be located anywhere and can be moved at will, the only labor involved being that of mixing the feed and keeping the troughs supplied. This supplemental feeding can be done at the exact points where grazing use of the cured herbage would otherwise be too light, and more uniform and efficient utilization of the range resource is encouraged.